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BIOLOGICAL EFFECTS OF WASTES DISCHARGED TO THE NORTH PLATTE RIVER, TORRINGTON, WYOMING-BRIDGEPORT NEBRASKA, NOVEMBER 14 AND 15, 1962

PUBLIC HEALTH SERVICE, KANSAS CITY, MISSOURI

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Biological Effects of Wastes Discharged to the North Platte River, Torrington, Wyoming - Bridgeport, Nebraska

November 14 & 15, 1962

U.S. PUBLIC HEALTH SERVICE, REGION VI

WATER SUPPLY & POLLUTION CONTROL PROGRAM

KANSAS CITY, MISSOURI

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In a study of the biological effects of wastes discharged to the North Platte River, collections and observations in 1962 were made at most localitites selected in 1960 and 1961. Access to desired sampling areas was denied by deep water alongshore channels at one station and a drop in water level exposed all benthic habitat areas at another station. Results are given regarding general appearance, algae and slime growths, and benthic animals. Tables are included.

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Biological Effects of Wastes Discharged to the North Platte River, Torrington, Wyoming - Bridgeport, Nebraska November 14 and 15, 1962

Joe K. Neel
Biological Consultant
Water Supply and Pollution Control Program
U. S. Public Health Service, Region VI
Kansas City, Missouri

Collections and observations in 1962 were made at most localities selected in 1960 and 1961 (Table 1). Access to desired sampling areas was denied by deep water in alongshore channels at Station 9 and a drop in water level exposed all benthic habitat areas at Station 5. The area below the bridge at McGrew was substituted for Station 9.

General Appearance

Clear water passing under the Torrington, Wyoming bridge (Station 1) was still discolored along the right bank by turbid wastes leaving the beet plant outfall. These discharges lacked the foam and beet particles that were salient items during the 1960 and 1961 beet campaigns. The right half of the river alone remained muddied downstream past Station 3-R, but wastes spread to encompass the entire river width shortly above Station 3. Stations 3, 4, 5, and 6 were noticeably less turbid than during November 1960 or 1961. Turbidity increased at Station 7 and again at Station 8, and remained near the latter level past Station 10 (Bridgeport). Concentration at all stations was obviously below 1961 levels. Accumulations of beet debris were nowhere noticeable, but cossettes and pulp fibers were recovered, at all stations sampled, except 1

NORTH PLATTE RIVER

Table 1. Biological Sampling Sites 1962

STATION	LOCATION	RIVER MILE ABOVE MOUTH
1	Torrington, Wyoming	208.5
2-L	Left side of River, 1 mile below Station 1	207.5
2-R	Right side of River, at above point	207.5
3	Gering-Mitchell Diversion Dam - Wyoming	199.5
4	Henry, Nebraska	199
6	Mitchell, Nebraska	184.7
7	West Scottsbluff, Nebraska Bridge	178
8	Minatare-Melbeta Bridge	165.5
-	McGrew, Nebraska	160.2
10	Bridgeport, Nebraska	141.5

Station 9, Bayard, Nebraska, mile 154.6, not used.

and 2L, from masses of flotsam and jetsam caught on driftwood, fences, bridge piers, etc.

Waste solids settled on the bottom in appreciable quantities along the right half of the river from the Torrington beet plant outfall to some distance below Station 2-R. At 2-R, the bottom was covered with sludge and silt from the right shore to past midstream. The thin gray upper layer of this deposit covered a black stratum two to four inches thick. At Station 3, the upstream face of the dam bore blankets of sludge, but bottom in all other areas at that locality was sand or sand and rocks. Sand was the only bottom material observed at Stations 4 and 5, but silt and sludge accumulations were noted atop sand along the right bank at Stations 6 and 7. Bottom could not be observed at Station 8. Sand was the only component noted at McGrew and Station 10. Driftwood, pieces of fence, weeds and other materials anchored in the sand, and debris caught on such obstructions, were the principal habitats of algae and bottom animals below Station 2-L.

Algae and Slime Growths

Sphaerotilus formed a pinkish waving blanket over large areas of the sludge deposited along the right half of the stream bed at Station 2-R. It occurred in scattered patches at Station 3 and in sparse amounts intermixed with benthic algae at Stations 3 and 4. It was not recovered below Station 4. (Table 2).

Composition of benthic algal growths sampled at each station also appears in Table 2. The most abundant widespread species, Diatoma vulgare, invested other algae, weeds and grasses, and various other sub-

Table 2 Benthic Algae - North Platte River - November 14-15, 1962

Station number	1	2L	2R	3	4	6	7	8	McGrew	10
Green Algae										
Cladophora sp.	+	+		+	+	+	+	+	+	+
Closterium sp.	+			+		+				
Cosmarium sp.	+									
Microspora sp.	+	+		+						
Oedogonium	+									
Pediastrum integrum		+		+						
Scenedesmus armatus		+								
Spirogyra				+					+	
Diatoms										
Amphora sp.	+									
Cocconeis pediculus	+	+		+			+	+	+	
Cymatopleura solea	+			+	+					
Cymbella aspera	+	+		+		+	+			
Cymbella sp.	+	+		+	+	+	+		+	
Diatoma vulgare	+	+		+	+	+	+	+	+	+
Gomphonema sp.		+		+			+		+	
Gyrosigma										+
Mastogloia smithii	+	+		+	+	+	+		+	+
Melosira granulata		+		+		+		+		
Navicula cuspidata	+			+		+		+	+	
Nitzschia elongata	+	+		+	+	+	+	+	+	+
Nitzschia sigmoidea	+			+			+			
Pleurosigma delicatulum	+	+		+		+	+			
Stauroneis sp.							+			
Stephanodiscus astraea	+									
Surirella sp.				+	+	+			+	+
Synedra amphicephala		+		+		+	+			
Blue-green Algae										
Chroococcus sp.	+								+	
Phormidium sp.	+	+	+	+						
Merismopedia elegans	+	+								
Euglenophyta										
Euglena sp.		+		+						
Red Algae										
Compsopogon sp.	+	+				+	+			
Sphaerotilus			+	+	+					

merged substrates. Cladophora formed rather luxuriant growths at Stations ., 2-L, 10 and at McCrew. Red algae (Compsopogon) occurred as widely scattered small saccate growths that bore very few short filaments. Diatoms other than Diatoma vulgare, Cocconeis, Synedra amphicephala (which were attached to other algae, grasses, weeds, etc.) were components of brown gelatinous layers on sand, driftwood, and stones. Chroococcus, Merismopedia, and Euglena occurred in the interstices of green algae and filamentous diatoms. Phormidium formed small scattered dark blue-green patches.

At Station 1, green algae (Cladophora and Oedogonium) were largely concentrated on the riffle near the right bank below the coffer dam and caught on driftwood along the lip of the dam. Floating fronds frequently drifted over the sandy area above the dam. Brown diatom layers covered large areas of sand and gravel bottoms under the bridge and floating patches of such growths dislodged from upstream sites were common. Diatoma was attached to other algae and smaller pieces of driftwood. At Station 2-L, the gravel and sandy bottom was largely covered with green algae that were very densely invested with Diatoma, Synedra, and Cocconeis. A few scattered areas bore brown plate-like layers of other diatoms. At Station 2-R, the Sphaerotilus carpet contained a few scattered blue-green tufts of Phormidium. Bottom at Station 3 bore widely dispersed clumps of Sphaerotilus. Algae grew there on sand, on sticks and other detritus caught in sand, on rocks near the dam, and on the walls of the control channel and ditch control gate. Patches of diatom jellies were common on stable sand along the left shore. At Station 4, the most conspicuous algal growths were attached to driftwood, but some diatom films were seen on the sandy

bottom near the right bank. Algae were rather scarce at Station 6. Some diatom films occurred on the bottom in shallow areas, and Diatoma and other diatoms invested some sticks and grasses. Green algae (Cladophora) formed very minute portions of attached growths. Coontail (an aquatic flowering plant) was recovered from debris accumulations.

At Station 7, green algae were somewhat more numerous than at Station 6. Diatoma and its associates occurred with the green algae and other diatoms formed brown gelatinous films on stable bottom areas and logs and planks comprising a driftwood accumulation at the bridge. At Station 8, algae, (green algae and diatoms) occurred only on driftwood and other detritus. None were attached to bottom or bridge piers and the suspicion arises that algae noted on obstructions there had not developed on such sites but had recently been stranded as they floated downstream. Pieces of coontail were also present in accumulated debris. At McGrew the bottom had been disturbed to a considerable extent by dredging and filling concomittant to construction of a new bridge, but numerous waving algal fronds were attached to detritus caught on various anchored pieces of wood, weeds, wires, etc. At Station 10, algae grew on sticks, boards, and debris caught on obstructions beneath the bridge, and on submerged grasses along the shore. Diatoma was especially conspicuous on the grasses.

In November 1960, algae disappeared at Station 3 and were absent from there down to Mitchell, where collections stopped. In October and November, 1961, benthic algae were found at Stations 1, 2-L, 4, 6, 7, and 9. Sphaerotilus occurred at all stations except 1 in 1961 and was the only growth present at 2-R, 3, and 5. Turbidity appeared lower in the fall of 1961 than

during the 1960 beet campaign.

Benthic Animals

At Station 1, habitat for this group consisted of various sized stones, driftwood tangles, and debris caught on various obstructions. At 2-L, they lived among gravel and small stones and on driftwood and its accumulated debris. At all other stations organisms were found only on driftwood and debris accumulations.

Distribution of various bottom dwelling animals found in November 1963, is shown in Table 3. The maximum number of species (20) occurred at Station 1. No organisms were found at 2-R, but decimation in number of forms was otherwise not very marked until Station 6, where only seven occurred. Caddis flies (Trichoptera) and stone flies (Plecoptera) appeared least tolerant of the waste components discharged at Torrington and below. Appearance of the stone fly (Allocapnia) at Station 10 could possibly be interpreted to indicate some degree of recovery, although the number of species had not increased over that noted at McGrew and Station 8. Pollutional effects were seemingly most pronounced at Station 7 where only four different organisms occurred.

In the fall of 1960, benthic animals were eliminated from the right half of the stream bed from the Torrington outfall down to Station 3 and from the entire stream bed from Stations 3 to 6. In 1961, beet wastes eradicated this class of organisms at Stations 2-R, 4 and 8 before November 1 (the beet campaign began around October 1) and numbers of organisms were severely reduced at most other stations before October 31. The following table indicates the number of survivors at each station each

Table 3 Individual Benthos Analyses on North Platte River - November 1962

Station Number	1	2	3	4	6	7	8	9	10
Gyrinus sp.	x								
Diptera									
Calopsectra sp.	x	x		x					
Chironomus militaris Joh.					x				
Cricotopus exilis Joh.								x	
Cricotopus (Group C - Edwards)				x					
Diamesia nivoriunda				x					
Diamesia sp.		x	x						
Glyptotendipes senilis		x				x			
Pentaneura flavifrons gr.		x							
Similium sp.	x	x	x	x	x		x	x	x
Spaniotoma (O.) obrumbrata Joh.	x	x	x	x					
Spaniotoma (O.) nivoriunda	x	x	x		x		x	x	
Spaniotoma sp.	x								
Tipula sp.	x								
NEMATODA SP.	x	x							

Table 3 Individual Benthos Analyses on North Platte River - November 1962

Station Number	1	2	3	4	6	7	8	9	10
PLATYHELMINTHES									
Dugesia sp.	x			x					
ANNELIDA									
Tubificidae							x		
Placobdella ornata (Verrill)				x					
MOLLUSCA									
Gastropoda									
Physa sp.			x	x		x			
CRUSTACEA									
Amphipoda									
Hyalella azteca				x	x	x	x		x
Isopoda									
Asellus militaris							x	x	x
INSECTA									
Plecoptera									
Allocapnia mystica Frison									x
Isoperla sp.	x	x	x						
Ephemeroptera									
Centroptilium sp.		x							
Ephemerella excrucians	x	x	x	x				x	
Heptagenia diabasia	x	x	x	x	x	x	x	x	x
Heptagenia flavescens	x								
Heptagenia marginalis		x	x	x					
Heterocloen sp.		x	x	x	x		x	x	x
Leptophlebia sp.	x		x	x					
Tricorythodes sp.		x	x		x				
Odonata									
Argia sp.	x								
Hetaerina sp.	x		x						
Ophiogomphus sp.	x	x							
Hemiptera									
Ambrysus mormon montadon	x	x	x						
Lethocerus americanus									x
Trichoptera									
Hydropsyche sp. 1	x	x	x	x					
Hydropsyche sp. 2	x								
Coleptera									

year.

	No. Forms 1961 (Oct 31-Nov 2)	1962 (Nov 14-15)
Station 1	23	20
2-L	17	18
2-R	0	0
3	4	15
4	0	15
6	7	7
7	4	4
8	0	7
McGrew	-	7
9	1	-
10	6	7

Conditions were considerably improved from the benthos viewpoint in 1962. The Torrington waste load eliminated or markedly reduced the population along the right bank only in reaches above Station 3 as contrasted with significant reduction or eradication down to Station 4 in 1961. Wastes discharged from the Mitchell beet plant had adverse effects at the West Scottsbluff bridge (Station 7) each year, but reductions in the waste load from the Scottsbluff beet plant in 1962 were seemingly responsible for survival at Station 8 of a number of forms that perished there during the 1961 beet campaign. It is assumed that survival in reaches between Stations 8 and 10 was also enhanced by wastes reduction effected at Scottsbluff. Discharge from the treatment area at the Bayard beet plant was clear and apparently lacked sphaerotilogenic materials on November 15, 1962.

Greater survival of benthic algae and animals and decreased production of Sphaerotilus in 1962 appeared to be directly related to decreased waste loads leaving the Torrington and Scottsbluff beet factories. Con-

ditions in the river reach below the Mitchell beet plant allowed about the same degree of organisms survival as was noted in 1961, and it would appear that no improvement in waste removal was realized at that plant. Biological resources of the river still suffered deleterious effects traceable to beet plant discharges. Conditions were much improved at the Wyoming-Nebraska boundary; and the most undesirable conditions were promoted by discharges from beet plants located in Nebraska.

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